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| First Named Inventor | Koichiro TANAKA |
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| Remarks <input checked="" type="checkbox"/> The Commissioner is hereby authorized to charge any additional fees required or credit any overpayments to Deposit Account No. 50-2280 for the above identified docket number. | | |

SIGNATURE OF APPLICANT, ATTORNEY, OR AGENT

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|-------------------------------|--|
| Firm or Individual name | Eric J. Robinson, Reg. No. 38,285 Robinson Intellectual Property Law Office, P.C. PMB 955 21010 Southbank Street Potomac Falls, VA 20165 |
| Signature | |
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Attorney Docket No. 0756-7197

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent Application of:

Koichiro TANAKA

Serial No. 10/664,916

Filed: September 22, 2003

For: BEAM HOMOGENIZER AND LASER
IRRADIATION APPRATUS AND
METHOD OF MANUFACTURING
SEMICONDUCTOR DEVICE

) Group Art Unit: 1792

) Examiner: Robert M. Kunemund

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) Adam M. Stamps

RESPONSE TO NOTIFICATION OF NON-COMPLIANT APPEAL BRIEF

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

In response to the *Notification of Non-Compliant Appeal Brief* mailed January 16, 2009, the Appellant submits herewith a revised Summary of Claimed Subject Matter (37 CFR § 41.37(c)(1)(v)). The Appellant respectfully submits that the revised Summary meets the conditions of Rule 37(c)(1)(v).

V. SUMMARY OF CLAIMED SUBJECT MATTER

Please incorporate by reference the Summary of Claimed Subject Matter submitted with the *Appeal Brief* filed November 14, 2008 (received by OIPE November 17, 2008).

Independent claim 1 recites a beam homogenizer comprising: a cylindrical lens (e.g. 1105) for converging a laser light in a width direction (e.g. Figure 2B, between 1105 and 1106); and a light guide (e.g. 1106) for homogenizing an energy distribution of the laser light along the width direction (e.g. a direction of a short side) of a line-shape on an irradiated surface (e.g. 1108; page 6, lines 13 to 18), wherein a beam spot of the laser light is shaped into the line-shape on the irradiated surface (e.g. Figures 2A and 2B), wherein the light guide comprises two reflective surfaces facing to each other (e.g.

page 7, lines 17 to 26; page 9, line 32 to page 10, line 10 and Figures 2A and 2B), and wherein the width direction is a direction of a short side of the line-shape on the irradiated surface (e.g. Figure 2B).

Independent claim 3 recites a beam homogenizer comprising: a cylindrical lens (e.g. 1105) for converging a laser light in a width direction (e.g. Figure 2B, between 1105 and 1106); and a light pipe (e.g. page 7, lines 17 to 22) for homogenizing an energy distribution of the laser light along the width direction (e.g. a direction of a short side) of a line-shape on an irradiated surface (e.g. 1108; page 6, lines 13 to 18), wherein a beam spot of the laser light is shaped into the line-shape on the irradiated surface (e.g. Figures 2A and 2B), wherein the light pipe comprises two reflective surfaces facing to each other (e.g. page 7, lines 17 to 26; page 9, line 32 to page 10, line 10 and Figures 2A and 2B), and wherein the width direction is a direction of a short side of the line-shape on the irradiated surface (e.g. Figure 2B).

Independent claim 5 recites a beam homogenizer comprising: a first cylindrical lens (e.g. 1105) for converging a laser light in a width direction (e.g. Figure 2B, between 1105 and 1106); a light guide (e.g. 1106) for homogenizing an energy distribution of the laser light along the width direction (e.g. a direction of a short side) of a line-shape on an irradiated surface (e.g. 1108; page 6, lines 13 to 18); and at least one second cylindrical lens (e.g. pages 10, lines 17-30 and Figures 2A and 2B (doublet cylindrical lens 1107a or 1107b)) for condensing the laser light output from the light guide along the width direction of the line-shape on the irradiated surface, wherein a beam spot of the laser light is shaped into the line-shape on the irradiated surface (e.g. Figures 2A and 2B), wherein the light guide comprises two reflective surfaces facing to each other (e.g. page 7, lines 17 to 26; page 9, line 32 to page 10, line 10 and Figures 2A and 2B), and wherein the width direction is a direction of a short side of the line-shape on the irradiated surface (e.g. Figure 2B).

Independent claim 7 recites a beam homogenizer comprising: a first cylindrical lens (e.g. 1105) for converging a laser light in a width direction (e.g. Figure 2B, between 1105 and 1106); a light pipe (e.g. page 7, lines 17 to 22) for homogenizing an energy distribution of the laser light along the width direction (e.g. a direction of a short side) of

a line-shape on an irradiated surface (e.g. 1108; page 6, lines 13 to 18); and at least one second cylindrical lens (e.g. pages 10, lines 17-30 and Figures 2A and 2B (doublet cylindrical lens 1107a or 1107b)) for condensing the laser light output from the light pipe along the width direction of the line-shape on the irradiated surface, wherein a beam spot of the laser light is shaped into the line-shape on the irradiated surface (e.g. Figures 2A and 2B), wherein the light pipe comprises two reflective surfaces facing to each other (e.g. page 7, lines 17 to 26; page 9, line 32 to page 10, line 10 and Figures 2A and 2B), and wherein the width direction is a direction of a short side of the line-shape on the irradiated surface (e.g. Figure 2B).

Independent claim 9 recites a beam homogenizer comprising: a unit (e.g. 1103a, 1103b or 1104) for homogenizing an energy distribution of a laser light along a length direction (e.g. a direction of a long side) of a line-shape on an irradiated surface (e.g. 1108; page 10, line 31 to page 11, line 10 and Figures 2A and 2B); a cylindrical lens (e.g. 1105) for converging the laser light in a width direction (e.g. Figure 2B, between 1105 and 1106); and a light guide (e.g. 1106) for homogenizing the energy distribution along the width direction of the line-shape on the irradiated surface, wherein the unit has at least a cylindrical lens array (e.g. 1103a, 1103b), wherein a beam spot of the laser light is shaped into the line-shape on the irradiated surface (e.g. Figures 2A and 2B), wherein the light guide comprises two reflective surfaces facing to each other (e.g. page 7, lines 17 to 26; page 9, line 32 to page 10, line 10 and Figures 2A and 2B), and wherein the width direction is a direction of a short side of the line-shape on the irradiated surface and the length direction is a direction of a long side of the line-shape on the irradiated surface (e.g. Figures 2A and 2B).

Independent claim 11 recites a beam homogenizer comprising: a unit (e.g. 1103a, 1103b or 1104) for homogenizing an energy distribution of a laser light along a length direction (e.g. a direction of a long side) of a line-shape on an irradiated surface (e.g. 1108; page 10, line 31 to page 11, line 10 and Figures 2A and 2B); a cylindrical lens (e.g. 1105) for converging the laser light in a width direction (e.g. Figure 2B, between 1105 and 1106); and a light pipe (e.g. page 7, lines 17 to 22) for homogenizing the energy distribution along the width direction of the line-shape on the irradiated surface,

wherein the unit has at least a cylindrical lens array (e.g. 1103a, 1103b), wherein a beam spot of the laser light is shaped into the line-shape on the irradiated surface (e.g. Figures 2A and 2B), wherein the light pipe comprises two reflective surfaces facing to each other (e.g. page 7, lines 17 to 26; page 9, line 32 to page 10, line 10 and Figures 2A and 2B), and wherein the width direction is a direction of a short side of the line-shape on the irradiated surface and the length direction is a direction of a long side of the line-shape on the irradiated surface (e.g. Figures 2A and 2B).

Independent claim 13 recites a laser irradiation apparatus comprising: a laser oscillator (e.g. 1101; page 9, lines 27-28 and Figures 2A and 2B); and a beam homogenizer, wherein the beam homogenizer comprises a cylindrical lens (e.g. 1105) for converging a laser light in a width direction (e.g. Figure 2B, between 1105 and 1106) and a light guide (e.g. 1106) for homogenizing an energy distribution of the laser light along the width direction (e.g. a direction of a short side) of a line-shape, wherein a beam spot of the laser light is shaped into the line-shape on an irradiated surface (e.g. 1108), wherein the light guide comprises two reflective surfaces facing to each other (e.g. page 7, lines 17 to 26; page 9, line 32 to page 10, line 10 and Figures 2A and 2B), and wherein the width direction is a direction of a short side of the line-shape on the irradiated surface (e.g. Figure 2B).

Independent claim 16 recites a laser irradiation apparatus comprising: a laser oscillator (e.g. 1101; page 9, lines 27-28 and Figures 2A and 2B); and a beam homogenizer, wherein the beam homogenizer comprises a first cylindrical lens (e.g. 1105) for converging a laser light in a width direction (e.g. Figure 2B, between 1105 and 1106), a light guide (e.g. 1106) for homogenizing an energy distribution of the laser light along the width direction (e.g. a direction of a short side) of a line-shape, and at least one second cylindrical lens (e.g. pages 10, lines 17-30 and Figures 2A and 2B (doublet cylindrical lens 1107a or 1107b)) for condensing the laser light output from the light guide along the width direction of the line-shape, wherein the light guide comprises two reflective surfaces facing to each other (e.g. page 7, lines 17 to 26; page 9, line 32 to page 10, line 10 and Figures 2A and 2B), wherein a beam spot of the laser light is shaped into the line-shape on an irradiated surface (e.g. 1108), and wherein the width

direction is a direction of a short side of the line-shape on the irradiated surface (e.g. Figure 2B).

Independent claim 19 recites a laser irradiation apparatus comprising: a laser oscillator (e.g. 1101; page 9, lines 27-28 and Figures 2A and 2B); and a beam homogenizer, wherein the beam homogenizer comprises a cylindrical lens (e.g. 1105) for converging a laser light in a width direction (e.g. Figure 2B, between 1105 and 1106) and a light pipe (e.g. page 7, lines 17 to 22) for homogenizing an energy distribution of the laser light along the width direction (e.g. a direction of a short side) of a line-shape, wherein a beam spot of the laser light is shaped into the line-shape on an irradiated surface (e.g. 1108), wherein the light pipe comprises two reflective surfaces facing to each other (e.g. page 7, lines 17 to 26; page 9, line 32 to page 10, line 10 and Figures 2A and 2B), and wherein the width direction is a direction of a short side of the line-shape on the irradiated surface (e.g. Figure 2B).

Independent claim 22 recites a laser irradiation apparatus comprising: a laser oscillator (e.g. 1101; page 9, lines 27-28 and Figures 2A and 2B); and a beam homogenizer, wherein the beam homogenizer comprises a first cylindrical lens (e.g. 1105) for converging a laser light in a width direction (e.g. Figure 2B, between 1105 and 1106), a light pipe (e.g. page 7, lines 17 to 22) for homogenizing an energy distribution of the laser light along the width direction (e.g. a direction of a short side) of a line-shape, and at least one second cylindrical lens (e.g. pages 10, lines 17-30 and Figures 2A and 2B (doublet cylindrical lens 1107a or 1107b)) for condensing the laser light output from the light pipe along the width direction of the line-shape, wherein the light pipe comprises two reflective surfaces facing to each other (e.g. page 7, lines 17 to 26; page 9, line 32 to page 10, line 10 and Figures 2A and 2B), wherein a beam spot of the laser light is shaped into the line-shape on an irradiated surface (e.g. 1108), and wherein the width direction is a direction of a short side of the line-shape on the irradiated surface (e.g. Figure 2B).

Independent claim 25 recites a method of manufacturing a semiconductor device, comprising the steps of: forming a non-single-crystal (e.g. page 13, lines 18-24) semiconductor film on a substrate (e.g. page 11, line 33 to page 12, line 13); generating

a laser beam with a laser beam oscillator (e.g. 1101; page 12, lines 14 to page 13, line 2); using at least a cylindrical lens array (e.g. 1103a, 1103b), a cylindrical lens (e.g. 1105) and a light guide (e.g. 1106) to shape the laser beam so as to form a linear beam spot of a laser light on an irradiated surface (e.g. 1108) with its energy distribution along a width direction (e.g. a direction of a short side) homogenized (e.g. page 13, line 30 to page 14, line 8); setting the substrate with the non-single-crystal semiconductor film formed thereon on a stage to make a surface of the non-single-crystal semiconductor film coincide with the irradiated surface (e.g. page 12, line 25, to page 13, line 2); and performing a laser annealing of the non-single-crystal semiconductor film by irradiating the semiconductor film surface with the linear laser light while causing the stage to scan relative to the laser light (e.g. page 12, line 25, to page 13, line 6), wherein the cylindrical lens array acts on the linear beam spot along a length direction (e.g. a direction of a long side) of the spot, wherein the light guide and the cylindrical lens act on the linear beam spot along the width direction of the spot, wherein the light guide comprises two reflective surfaces facing to each other (e.g. page 7, lines 17 to 26; page 9, line 32 to page 10, line 10 and Figures 2A and 2B), and wherein the width direction is a direction of a short side of the linear beam spot and the length direction is a direction of a long side of the linear beam spot (e.g. Figures 2A and 2B).

Independent claim 28 recites a method of manufacturing a semiconductor device, comprising the steps of: forming a non-single-crystal (e.g. page 13, lines 18-24) semiconductor film on a substrate (e.g. page 11, line 33 to page 12, line 13); generating a laser beam with a laser beam oscillator (e.g. 1101; page 12, lines 14 to page 13, line 2); using at least a cylindrical lens array (e.g. 1103a, 1103b), a first cylindrical lens (e.g. 1105), a light guide (e.g. 1106) and a second cylindrical lens to shape the laser beam so as to form a linear beam spot of a laser light on an irradiated surface (e.g. 1108) with its energy distribution along a width direction (e.g. a direction of a short side) homogenized; setting the substrate with the non-single-crystal semiconductor film formed thereon on a stage to make a surface of the non-single-crystal semiconductor film coincide with the irradiated surface (e.g. page 12, line 25, to page 13, line 2); and performing a laser annealing of the non-single-crystal semiconductor film by irradiating

the semiconductor film surface with the linear laser light while causing the stage to scan relative to the laser light (e.g. page 12, line 25, to page 13, line 6), wherein the cylindrical lens array acts on the linear beam spot along a length direction (e.g. a direction of a long side) of the spot, wherein the light guide, the first cylindrical lens and the second cylindrical lens act on the linear beam spot along the width direction of the spot, wherein the light guide comprises two reflective surfaces facing to each other (e.g. page 7, lines 17 to 26; page 9, line 32 to page 10, line 10 and Figures 2A and 2B), and wherein the width direction is a direction of a short side of the linear beam spot and the length direction is a direction of a long side of the linear beam spot (e.g. Figures 2A and 2B).

Independent claim 31 recites a method of manufacturing a semiconductor device, comprising the steps of: forming a non-single-crystal (e.g. page 13, lines 18-24) semiconductor film on a substrate (e.g. page 11, line 33 to page 12, line 13); generating a laser beam with a laser beam oscillator (e.g. 1101; page 12, lines 14 to page 13, line 2); using at least a cylindrical lens array (e.g. 1103a, 1103b), a cylindrical lens (e.g. 1105) and a light pipe (e.g. page 7, lines 17 to 22) to shape the laser beam so as to form a linear beam spot of a laser light on an irradiated surface (e.g. 1108) with its energy distribution along a width direction (e.g. a direction of a short side) homogenized (e.g. page 6, lines 13 to 18); setting the substrate with the non-single-crystal semiconductor film formed thereon on a stage to make a surface of the non-single-crystal semiconductor film coincide with the irradiated surface (e.g. page 12, line 25, to page 13, line 2); and performing a laser annealing of the non-single-crystal semiconductor film by irradiating the semiconductor film surface with the linear laser light while causing the stage to scan relative to the laser light (e.g. page 12, line 25, to page 13, line 6), wherein the cylindrical lens array acts on the linear beam spot along a length direction (e.g. a direction of a long side) of the spot, wherein the light pipe and the cylindrical lens act on the linear beam spot along the width direction of the spot, wherein the light pipe comprises two reflective surfaces facing to each other (e.g. page 7, lines 17 to 26; page 9, line 32 to page 10, line 10 and Figures 2A and 2B), and wherein the width direction is a direction of a short side of the linear beam spot and the

length direction is a direction of a long side of the linear beam spot (e.g. Figures 2A and 2B).

Independent claim 34 recites a method of manufacturing a semiconductor device, comprising the steps of: forming a non-single-crystal (e.g. page 13, lines 18-24) semiconductor film on a substrate (e.g. page 11, line 33 to page 12, line 13); generating a laser beam with a laser beam oscillator (e.g. 1101; page 12, lines 14 to page 13, line 2); using at least a cylindrical lens array (e.g. 1103a, 1103b), a first cylindrical lens (e.g. 1105), a light pipe (e.g. page 7, lines 17 to 22) and a second cylindrical lens to shape the laser beam so as to form a linear beam spot of a laser light on an irradiated surface (e.g. 1108) with its energy distribution along a width direction (e.g. a direction of a short side) homogenized; setting the substrate with the non-single-crystal semiconductor film formed thereon on a stage to make a surface of the non-single-crystal semiconductor film coincide with the irradiated surface (e.g. page 12, line 25, to page 13, line 2); and performing a laser annealing of the non-single-crystal semiconductor film by irradiating the semiconductor film surface with the linear laser light while causing the stage to scan relative to the laser light (e.g. page 12, line 25, to page 13, line 6), wherein the cylindrical lens array acts on the linear beam spot along a length direction (e.g. a direction of a long side) of the spot, wherein the light pipe, the first cylindrical lens and the second cylindrical lens act on the linear beam spot along the width direction of the spot, wherein the light pipe comprises two reflective surfaces facing to each other (e.g. page 7, lines 17 to 26; page 9, line 32 to page 10, line 10 and Figures 2A and 2B), and wherein the width direction is a direction of a short side of the linear beam spot and the length direction is a direction of a long side of the linear beam spot (e.g. Figures 2A and 2B).

Independent claim 37 recites a method of manufacturing a semiconductor device comprising: providing a laser light; passing the laser light through a cylindrical lens (e.g. 1105) for converging the laser light in a width direction (e.g. a direction of a short side) (e.g. Figure 2B, between 1105 and 1106) (e.g. page 10, line 31 to page 11, line 10 and Figures 2A and 2B); passing the laser light through a light guide (e.g. 1106); and irradiating a semiconductor film with the laser light after passing through the light guide

to crystallize the semiconductor film (e.g. page 11, lines 19 to 24; page 12, line 7 to page 13, line 24; and page 16, lines 11 to 15), wherein an energy distribution along the width direction of the laser light at a surface of the semiconductor film is homogenized by the light guide (e.g. page 6, lines 13 to 18), wherein the light guide comprises two reflective surfaces facing to each other (e.g. page 7, lines 17 to 26; page 9, line 32 to page 10, line 10 and Figures 2A and 2B), and wherein the width direction is a direction of a short side of the laser light (e.g. Figure 2B).

Independent claim 39 recites a method of manufacturing a semiconductor device comprising: providing a laser light; passing the laser light through a cylindrical lens (e.g. 1105) for converging the laser light in a width direction (e.g. a direction of a short side) (e.g. Figure 2B, between 1105 and 1106) (e.g. page 10, line 31 to page 11, line 10 and Figures 2A and 2B); passing the laser light through a light pipe (e.g. page 7, lines 17 to 22); and irradiating a semiconductor film with the laser light after passing through the light pipe to crystallize the semiconductor film (e.g. page 11, lines 19 to 24; page 12, line 7 to page 13, line 24; and page 16, lines 11 to 15), wherein an energy distribution along the width direction of the laser light at a surface of the semiconductor film is homogenized by the light pipe (e.g. page 6, lines 13 to 18), wherein the light pipe comprises two reflective surfaces facing to each other (e.g. page 7, lines 17 to 26; page 9, line 32 to page 10, line 10 and Figures 2A and 2B), and wherein the width direction is a direction of a short side of the laser light (e.g. Figure 2B).

Independent claim 41 recites a method of manufacturing a semiconductor device comprising: providing a laser light having a cross section perpendicular to a propagation direction of the laser light wherein the cross section has a length (e.g. Figure 2A) and a width (e.g. Figure 2B); increasing only the length of the cross section of the laser light; passing the laser light through a cylindrical lens (e.g. 1105) for converging the laser light in a width direction (e.g. a direction of a short side) (e.g. Figure 2B, between 1105 and 1106) (e.g. page 10, line 31 to page 11, line 10 and Figures 2A and 2B); passing the laser light through a light guide (e.g. 1106); and irradiating a semiconductor film with the laser light after passing through the light guide to crystallize the semiconductor film (e.g. page 11, lines 19 to 24; page 12, line 7 to

page 13, line 24; and page 16, lines 11 to 15), wherein an energy distribution of the laser light along a width direction (e.g. a direction of a short side) of the cross section is homogenized by the light guide, wherein the light guide comprises two reflective surfaces facing to each other (e.g. page 7, lines 17 to 26; page 9, line 32 to page 10, line 10 and Figures 2A and 2B), and wherein the width direction is a direction of a short side of the laser light (e.g. Figure 2B).

Independent claim 44 recites a method of manufacturing a semiconductor device comprising: providing a laser light having a cross section perpendicular to a propagation direction of the laser light wherein the cross section has a length (e.g. Figure 2A) and a width (e.g. Figure 2B); increasing only the length of the cross section of the laser light; passing the laser light through a cylindrical lens (e.g. 1105) for converging the laser light in a width direction (e.g. a direction of a short side) (e.g. Figure 2B, between 1105 and 1106) (e.g. page 10, line 31 to page 11, line 10 and Figures 2A and 2B); passing the laser light through a light pipe (e.g. page 7, lines 17 to 22); and irradiating a semiconductor film with the laser light after passing through the light pipe to crystallize the semiconductor film (e.g. page 11, lines 19 to 24; page 12, line 7 to page 13, line 24; and page 16, lines 11 to 15), wherein an energy distribution of the laser light along a width direction (e.g. a direction of a short side) of the cross section is homogenized by the light pipe, wherein the light pipe comprises two reflective surfaces facing to each other (e.g. page 7, lines 17 to 26; page 9, line 32 to page 10, line 10 and Figures 2A and 2B), and wherein the width direction is a direction of a short side of the laser light (e.g. Figure 2B).

If the Examiner feels further discussions would expedite prosecution of this application, the Examiner is invited to contact the undersigned.

Respectfully submitted,


Eric J. Robinson
Reg. No. 38,285

Robinson Intellectual Property Law Office, P.C.
PMB 955
21010 Southbank Street
Potomac Falls, Virginia 20165
(571) 434-6789